The child with a limp - a symptom and not a diagnosis

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INTRODUCTION

The limping child frequently poses a diagnostic challenge and clinical assessment may not be easy. Epidemiological studies are sparse; in one study[1] children with an acute limp accounted for <2% of all paediatric emergency department attendances although the frequency may well be different in the primary care setting.

Trauma is the commonest cause of limping and many cases of atraumatic limp will resolve spontaneously. However limp is not a diagnosis and it is important to assess limping children carefully as rarer, but serious, causes can be associated with significant morbidity, and even mortality, if there is a delay in diagnosis.

Children warranting urgent investigation are the very young (< 3 years of age), the ill and febrile, the non-weight bearing and those with painful restricted hip movements. Teaching on the limping child correctly focuses on the hip, where significant pathology often occurs; however limp may be due to extra-articular causes or joint problems other than those affecting the hip; these can be easily missed without careful assessment.

WHAT IS MEANT BY THE TERM 'LIMPING'?

In most cases, and the focus of this article, acute limping describes an antalgic (painful) gait i.e. minimising weight bearing on a sore limb, with a shortened stance phase and increased swing phase of the gait cycle. Acute

refers to duration of 1-2 days in contrast to a chronic limp (> 6weeks) and sub-acute (2 days and up to 6 weeks). Subtle limping may be accentuated by asking the child to run - listening for an asymmetric cadence can be helpful. Limping is also used to describe other abnormal gait patterns, often due to a spectrum of causes that are not acute in origin (e.g. cerebral palsy) and not covered in detail in this article.

The age of the child is helpful in establishing a differential diagnosis (Table 1)[2, 3] which will be aided by careful initial assessment, judicious use and interpretation of blood tests, imaging and pattern recognition. A history of trauma is common in the young child and may be a 'red herring' co-existing with an alternative cause of limp. Conversely, the absence of witnessed trauma does not exclude it. Most importantly, the possibility of NAI must always be considered. Typical clinical presentations of the limping child (Table 2) may help to refine the differential diagnosis.

TABLE 1: COMMON AND SIGNIFICANT CAUSES OF LIMP BY AGE [2]

	0-3 years	**4-10 years**	**11-16 years**
In all patients consider	Osteomyelitis / septic arthritis Non-accidental injury Testicular torsion / inguinal hernia / appendicitis / Urine infection Juvenile Idiopathic Arthritis (JIA) Metabolic conditions (e.g. rickets) Haematological disease (e.g. sickle cell anaemia)		

Age dependent differential diagnoses to consider	Toddler's fracture Developmental dysplasia of the hip Neuroblastoma	Transient synovitis Perthes' disease Acute lymphocytic leukaemia	Slipped upper femoral epiphysis Primary bone tumours Osgood-Schlatter disease, Sinding Larsen syndrome

TABLE 2: TYPICAL CLINICAL PRESENTATIONS OF THE LIMPING CHILD

Diagnosis	Clinical features
Septic arthritis	Classically the child is unwell, febrile and often inconsolable, unable to weight bear with the joint being hot, red, swollen and tender (at the hip restricted movement may be sole finding). High WCC, ESR and CRP. Classical features may be "masked" if the child is immunosuppressed or has had recent antibiotics (partially treated septic arthritis).
Osteomyelitis	Usually unwell, febrile child and reluctant to weight bear. Limb may be swollen, warm, held flexed with bone tenderness. High WCC, ESR and CRP. Radiographs may be normal initially.
Transient synovitis of the hip	Typically boys (4-8 years), with preceding upper respiratory tract or gastrointestinal infection (7-10 days before), systemically well with acute onset, limited hip movement, reluctance to weight bear. WCC and ESR usually normal (or slightly elevated), Diagnosis of exclusion.
Perthes' disease	Typically boys (4-8 years), with insidious onset painless limp or activity related leg pain (may be referred to thigh or knee). Can be bilateral. FBC and ESR / CRP normal. Initial radiographs often normal but progress to avascular necrosis of the developing femoral head.
Juvenile idiopathic arthritis	Young children may not verbalise pain but present with observed limp, often intermittent, stiffness or gelling in mornings or after inactivity, change in mood, or regression of motor milestones. Joint swelling can be subtle. Child may seem otherwise well, blood tests may be normal. Hip monoarthritis is a very uncommon initial feature. Late presentation is suggested by leg length discrepancy and muscle wasting. Risk of potentially blinding uveitis.
Malignancy (e.g. leukaemia, neuroblastoma, bone tumours	Can be systemically well initially but often presents with "red flags" (systemic upset, fever, unremitting pain (with night waking), bone pain and tenderness, soft tissue or joint swelling or pathological fractures). Benign bone tumours e.g. osteoid osteoma, may present with night waking and pain which often responds to NSAIDS.
Developmental hip dysplasia	Painless limp observed since onset of walking; unilateral dislocations - *Trendelenburg gait*; bilateral dislocations - *waddling gait*. May have leg shortening, abnormal skin creases in legs and limited hip abduction. Abnormal radiograph.
Slipped upper femoral epiphysis	Typically overweight gonadally immature and hypothyroid children (boys > girls and over 10 years). Acute slip – sudden onset hip or knee pain (referred) with difficulty weight bearing and restriction of hip internal rotation (or abduction). Chronic slip more common. Trendelenburg gait may be apparent. Bilateral involvement (25-40%).
Non accidental injury	Suggested by the pattern of injury, delay in seeking medical attention, changeable or implausible history or mechanism of injury inconsistent with findings. Prior history of injuries or neglect.
Discitis	Usually affects toddlers. Can limp or refuse to weight bear. Tender spine. Adopt posture involving extension of the lumbar spine for comfort. Diagnosis may require bone scan as radiographs may be normal.
Lyme arthritis	Recent travel to an endemic area although the history of erythema migrans or a tick bite may be absent. May have neurological presentations (e.g. Bells palsy or meningitis).
Abdominal pathology	Urine infection, testicular torsion, appendicitis. May present with non-weight bearing or limp, with or without abdominal pain, bowel or urinary symptoms.
Toddler fracture	Subtle undisplaced spiral fracture of the tibia caused by sudden twist often after an unwitnessed fall. Preschool children. Localised tenderness over tibial shaft may be present. Initial radiographs may be normal. Non accidental injury must be considered.

Rickets	May have failure to thrive, poor growth with generalised bone pain, bone tenderness, skeletal deformities such as genu varum / valgum, muscle weakness, wrist swelling and even pathological fractures. Radiographs may be normal. Diagnosis requires bone biochemistry.

We present three case histories to highlight important diagnostic dilemmas and potential pitfalls when considering the acute limping child. We also summarise the evidence where available, and present a practical approach to investigations and initial management.

A CASE OF ACUTE LIMP WITH RED FLAG FEATURES

6 year old Jake presented to the Emergency Department (ED) with an 8 hour history of severe worsening left hip and thigh pain. He was previously fit and well apart from an upper respiratory tract infection 7 days previously. There was no history of preceding hip problems or trauma. He refused to weight bear and became very distressed with attempted examination of his hip. His temperature was 38.5°C and his mother had become worried when he was unable to sleep due to the pain. He was tachycardic, flushed and miserable. Systemic examination was unremarkable. Examination of his other joints was normal.

COMMENTS

An acute non-weight bearing limp makes diagnoses such as infection, trauma and malignancy more likely. “Red flags” for these conditions should be sought at initial presentation (Table 3) with evidence from clinical examination and other sources as appropriate (e.g. if non–accidental injury (NAI) is suspected).

TABLE 3: 'RED FLAGS' FOR SEVERE LIFE THREATENING CONDITIONS

Sepsis (septic arthritis or osteomyelitis)	Malignancy	Non-accidental injury[3]
Complete non-weight bearing Any attempt to passively move the limb is resisted and causes extreme distress Pain severe and non-remitting Limb held in a position which accommodates increased joint volume due to effusion Pseudo-paralysis of limb Night pain and waking Fever Immunocompromised child - increased risk of septic arthritis and osteomyelitis Back pain in the unwell child	Pain which is severe, non-remitting and occurs during the night Localised bone pain Pallor Bruising Lymphadenopathy Hepatosplenomegaly Anaemia, thrombocytopenia Systemic symptoms (lethargy, weight loss, night sweats, fever) Complete non-weight bearing Back pain in the unwell child Weight loss	Delay in seeking medical attention Changeable history inconsistent with pattern of injury Repeated presentations to health care Unwitnessed injury Patterns of injury suggestive of Non accidental injury: • Bruising over soft tissue areas, multiple bruises, bruises that carry the imprint of an implement • Distinctive burns e.g. round cigarette burn, forced immersion burn • Type of fracture e.g. metaphyseal • Multiple injuries Complete non-weight bearing with occult fracture Explanation not in-keeping with child's developmental stage Unkempt appearance and poor hygiene

Important key features of the history when eliciting "red flag" symptoms include; *characteristics of the pain* (e.g. site, trigger factors, effect of weight bearing), *the presence of systemic features* (e.g. fever, loss of appetite or weight), a*ny recent history of travel (e.*g. *to Lyme disease* endemic areas although it must be noted that the typical history of a rash or tick bite may be absent[4]) and *recent medication history* (e.g. recent antibiotic treatment may lead to partially treated septic arthritis or osteomyelitis).

- The clinical assessment (Table 4) needs to be comprehensive as the history may be relatively scant and young children frequently experience

non-specific pain (e.g. ‘my leg is hurting’)[7]. The hip will often be the initial focus of the examination, since acute unexplained limp is frequently caused by hip pathology. However referred pain must not be forgotten, and in the case of the hip, examination must include the spine, abdomen, pelvis and testes as appropriate. For other lower limb joints, a minimum of the joint above and below the affected joint must be examined. Septic arthritis tends to involve one joint but can (rarely) affect multiple joints – conversely, the involvement of multiple joints raises suspicion of a more systemic process (including malignancy) (Table 2 and 3).

- Clearly gait will be difficult to assess if the child is non-weight bearing, and in the severely ill child the approach to musculoskeletal examination will focus on passive rather than active movements but the key point is that all joints should be screened and pGALS may be helpful (see Table 4 and 5 below).

TABLE 4: CLINICAL ASSESSMENT OF THE ACUTE LIMPING CHILD

General examination	• Vital signs (heart rate, temperature, respiratory rate, blood pressure) • Evidence of anaemia, bruising, or lymphadenopathy • Evidence of rashes (e.g. exanthems, insect bites) • Abdominal examination (and testes in boys) • Lower limb neurological examination (e.g. nerve root irritation) • Pattern of injury and features to suggest non accidental injury
Musculoskeletal examination	• pREMS (paediatric Regional Examination of the Musculoskeletal System) based on the "look, feel, move, function, measure" approach to detailed joint examination [5], starting with the obvious affected limb or joint (s). Look • Skin changes over the joint • Joint swelling • Signs of discomfort • Signs of chronicity e.g. leg length discrepancy, fixed flexion deformity, muscle wasting/hypertrophy, deformity • Symmetrical skin creases • Soles of feet (for foreign bodies; evidence of trauma) • Alignment of spine and overlying skin changes Feel • Local tenderness and increased local temperature Move • Focus on spine and all joints in lower limbs • Range of movement (check for symmetry with other side and evidence of discomfort) Function • Weight bearing status and if can walk, observe the gait pattern (bearing in mind the child's age and stage of development). Measure • Leg length, muscle strength (as appropriate) • pGALS examination[6] may be helpful to identify abnormal joints elsewhere (Table 5)

TABLE 5: THE pGALS MUSCULOSKELETAL SCREENING EXAMINATION [6]

Screening questions	
	Do you (or does your child) have any pain or stiffness in your joints, muscles or back?
	Do you (or does your child) have any difficulty getting yourself dressed without any help?
	Do you (or does your child) have any difficulty going up and down stairs?
Gait	
	Observe the child walking and turning.
	"Walk on your tip-toes/walk on your heels"
Arms	
	"Put your hands out in front of you"
	"Turn your hands over and make a fist"
	"Pinch your index finger and thumb together"
	"Touch the tips of your fingers with your thumb"
	Squeeze metacarpophalangeal joints
	"Put your hands together/put your hands back to back"

	"Reach up and touch the sky" "Look up at the ceiling" "Put your hands behind your neck"
Legs	
	Feel for effusion at the knee "Bend and then straighten your knee" (active movement of knees and examiner feels for crepitus) Passive flexion (90 degrees) with internal rotation of the hip
Spine	
	"Open your mouth and put 3 of your fingers in your mouth" Lateral flexion of the spine: "Try and touch your shoulder with your ear Observe spine from behind "Can you bend and touch your toes" observe curve of spine from side and behind.

Further details are available with a video demonstration of pGALS performed on a normal child (www.arthritisresearchuk.org/health-professionals-and-students/video-resources/pgals.aspx).

The doctor who assessed Jake initially suspected septic arthritis or possibly reactive arthritis. Blood results showed a white cell count (WCC) of 11.5 X 10^9/L (90% neutrophils), C-reactive protein (CRP) of 30mg/l and Erythrocyte Sedimentation Rate (ESR) of 15 mm/hour. Blood film was normal. Plain radiography of the hip was normal. An urgent hip ultrasound scan (USS) confirmed a significant effusion.

COMMENTS

- During the assessment of a limping child who appears acutely unwell, essential investigations include full blood count (FBC), acute phase reactants (CRP, ESR), blood cultures, blood film with other tests depending on the clinical presentation (Table 6). The diagnosis of septic arthritis or osteomyelitis can be problematic as even patients with culture positive septic arthritis can have normal inflammatory markers and be apyrexial initially[8].

- Radiographs (including 'frog leg' lateral views) and urgent hip USS are required if clinical examination reveals the hip to be the suspected site of

pathology. It is important to note that hip pain can be referred to the knee.

TABLE 6: INVESTIGATIONS IN THE ACUTE LIMPING CHILD

Test	Diagnostic value of test
ESR	ESR becomes elevated 24-48 hours after the start of the inflammatory process but is normal in up to 25% of septic arthritis cases[8]; ESR of >40mm/hr is a risk factor for septic arthritis[9]. The sensitivity of an elevated ESR on admission to detect osteoarticular infection is 94%[10].
CRP	CRP becomes elevated earlier than ESR (within 6 hours of the inflammatory process). A CRP > 10 mg/l is generally accepted as a risk factor for septic arthritis[11,12]. Sensitivity of elevated CRP on admission is 95% [10].
Full blood count	A normal WCC count is present in 25-74% of septic arthritis cases[8].Neutrophilia is suggestive of septic arthritis. A WCC of >12 $x10^{-9}$ is generally accepted as a risk factor for septic arthritis[9,11,12]. Sensitivity and specificity of elevated WCC for septic arthritis is 75 and 55% respectively (13).
Blood Film	A normal blood film does not exclude leukaemia or other malignancy. A bone marrow aspirate may be required and specialist opinion is required where there is clinical concern.
Blood culture	Blood cultures are positive in 46-80% of patients with osteomyelitis[14,15], and 22-50% of patients with septic arthritis[16,17].
Anti-streptolysin O titre (ASOT) / anti-DNAse-B*	Raised ASOT suggests current or recent streptococcal infection and is present in up to 80% of patients with acute rheumatic fever. Sensitivity can be further increased by testing for additional antibodies such as anti-DNAse-B [8]. Throat swab also indicated but often negative.
Lactate Dehyrogenase (LDH)*	Raised levels can suggest malignancy (especially lymphoma) but sensitivity and specificity low. LDH is often raised in other conditions e.g. haemolysis, meningitis, encephalitis and pancreatitis.
Plain radiography	Diagnostic yield is low in young children (1-5 years) who have an otherwise normal examination and look well[18]. May be normal even with significant pathology (e.g. sepsis, early Perthes', transient synovitis, malignancy, JIA). Repeat radiographs after a period of review may be useful (e.g. detecting periosteal reaction in Toddler's fracture, or evolving Perthes' disease). Anterior-posterior and 'Frog leg lateral' hip x-rays should be undertaken in all children to detect early slipped upper femoral epiphysis (SUFE). Caution is required in conditions of the hip where bilateral changes may occur (e.g. SUFE, hip dyplasia).
Ultrasonography	Very sensitive in detecting hip and joint effusions. Operator dependent. Absence of effusion on hip USS makes septic arthritis very unlikely[19]. Ultrasound findings will not differentiate between infection, blood or reactive fluid. Does not exclude osteomyelitis but may show periosteal reaction suggestive of osteomyelitis.
Magnetic Resonance Imaging*	Very sensitive in identifying early sepsis, Perthes' disease, inflammatory disease and tumours when the pathological area is localised on clinical examination. May not always be able to differentiate infection from inflammation. Gadolinium enhancement can be used to improve detection of infection, synovitis and tumours. May need sedation/anaesthesia for younger children.
Bone Scan*	Very sensitive in identifying early osteomyelitis when an obvious focus of infection cannot be localised. Particularly useful when infection affects the pelvis or spine. May also detect early Perthes' disease, tumours and stress fractures such as toddler fractures and particularly when the history is vague.
Computerised tomography*	Useful to detect early bone changes of sepsis, and tumours and may detect occult fractures, but significant exposure to ionising radiation.

*Often omitted at acute presentation, but may be useful where the diagnosis remains unclear, not localised and the limp persists.

- Transient synovitis and septic arthritis can both result in significant effusions on USS and distinguishing between septic arthritis and transient synovitis is a matter of clinical judgement. Kocher *et al*[9] have proposed a "clinical prediction rule" which helps to differentiate septic arthritis from transient synovitis in the presence of a confirmed hip effusion. The risk of septic arthritis increases with the number of factors present (Box 1). The presence of elevated CRP levels (>10 ml/l) further increases the risk of sepsis[11,18].

BOX 1: KOCHER'S CRITERIA TO DIFFERENTIATE BETWEEN SEPTIC ARTHRITIS AND TRANSIENT SYNOVITIS IN THE PRESENCE OF CONFIRMED HIP EFFUSION[9]

Factors	
Fever >38^{o}C	
Unable to weight bear	
ESR > 40mm/hr	
Serum WCC >12x10^{6}/L	
Probability of septic arthritis	
No factors present	<0.2%
Two factors present	40%
Three factors present	93%
Four factors present	>99%

- If hip USS is normal but clinical concerns about septic arthritis or osteomyelitis remain, then bone scan or MRI are indicated to rule out osteomyelitis, psoas abscess or other potential septic "hot spots". The role of imaging and what tests to do and when remains controversial (Table 6). The choice of imaging modality is influenced by local access, clinical judgement and experience.

A presumptive diagnosis of septic arthritis was made based on the clinical presentation and investigations. Joint aspiration and wash-out was undertaken in theatre under general anaesthetic and synovial fluid was sent for microscopy and culture. Gram stain was negative but >50 000 / mm^3 white cells were seen on microscopy (mainly neutrophils). Intravenous (IV) antibiotics were commenced urgently. Jake was treated with IV antibiotics for 2 weeks, followed by 4 weeks of oral antibiotics. His symptoms improved rapidly and he made a full recovery.

- With such a patient, it is best to err on the side of caution and adopt a careful approach to management, rather than miss a septic joint. The hip joint should be drained, irrigated and synovial fluid sent for urgent microscopy, gram stain and culture. If there are concerns about atypical infection such as in the immunocompromised child it is important to discuss with microbiology and paediatric infectious disease colleagues to ensure that the appropriate tests are undertaken.

- Differentiating between septic arthritis and aseptic / inflammatory arthritis based on synovial fluid findings may be difficult as gram stain and culture has been reported to be negative in 50% - 80% of septic arthritis, and children with inflammatory and septic arthritis can have similar synovial fluid white cell counts [8,20].

- Empirical antibiotics must be started *urgently* in suspected septic arthritis with the choice of antibiotic altered if a causative organism is identified (Table 7). S*taphylococcus aureus* is the most common causative

organism. Septic arthritis is an orthopaedic emergency and outcomes can be dramatically worse if antibiotic treatment is delayed[21].

TABLE 7: COMMON CAUSATIVE ORGANISMS FOR SEPTIC ARTHRITIS AND SUGGESTED ANTIBIOTIC CHOICES

Common organisms	Suggested first line antibiotics[17]
Staphylococcus aureus	
• Methicillin sensitive	• First generation cephalosporin or clindamycin
• Significant prevalence of Methicillin resistant strains (MRSA, >10%)*	• Clindamycin
Streptococcus pneumoniae	• Benzylpenicillin IV or first generation cephalosporin
Streptococcus pyogenes	• Benzylpenicillin IV or first generation cephalosporin or clindamycin
Haemophilus influenzae	• Ampicillin / amoxicillin (add cefuroxime or ceftriaxone if β lactamase producing strain).

*Consult microbiologist for advice regarding local clindamycin / vancomycin resistance patterns.

- The response to antibiotic treatment is monitored clinically (temperature, pain, spontaneous movement of the joint) as well as by serial monitoring of inflammatory markers with normalisation of the CRP being the earliest laboratory parameter to indicate improvement[17]. Controversy exists regarding the length of treatment and when to switch to oral antibiotics but the regimes outlined above are commonly used in the first instance.

- In children under the age of two years, the blood supply to the joint is via the metaphysis, which may be intra-articular at certain joints (namely the hip, ankle, shoulder and elbow) and explains why septic arthritis and osteomyelitis frequently coexist at these sites. Diagnosing concomitant

osteomyelitis is important as it commonly requires a longer duration of antibiotics as compared to septic arthritis alone, and long-term sequelae are more likely.

- The outcome of septic arthritis is variable with worse prognosis occurring with hip involvement, associated proximal femur osteomyelitis, *Staphylococcus aureus* infection, onset in a child < 6 months of age, and where there has been a delay in diagnosis of ≥ 4 days. Potential sequelae following septic arthritis include avascular necrosis and premature degenerative joint disease [16, 22].
- Mycobacterial joint infection should be considered in high-risk patients (the immunosuppressed, ethnicity or family contacts), or if there is a history of increasing pain, night sweats and weight loss (with or without associated cough). Atypical mycobacteria and other unusual organisms (e.g. fungal infection) also need to be considered in Immunocompromised children.

A CASE OF SUB-ACUTE LIMP AND IRRITABLE HIP

6 year old James presented to the ED with left thigh pain and limp, having been reluctant to walk for 4 days. He continued to be playful if his toys were around him and he could remain seated. There was no history of previous joint problems, antecedent trauma or any other medical history of note. Although he had not had a temperature since the onset of the limp he had a sore throat 7 days before.

On examination he was apyrexial and alert. He improved following arrival in the ED, had a mildly antalgic gait on walking slowly but was happy to weight bear. When encouraged to run his limp was more pronounced. His left hip had a reduced range of movement compared with the right. A comprehensive musculoskeletal, neurological and systemic examination was undertaken and found to be unremarkable. Blood tests (FBC, ESR, CRP) and hip radiograph were all normal. James was allowed home with advice regarding analgesia and his parents were given written instructions of when to return to hospital (i.e. if he became unwell, developed a high temperature, had increasing leg pain or night pain, was unable to weight bear, developed involvement of other joints or if the limp persisted beyond two weeks).

COMMENTS

- James had no "red flag" features. He was not excessively distressed, was able to weight bear with some movement of his hip. The initial acute investigations of such children is controversial with a wide variation in clinical practice, from "watchful waiting" to blood tests and plain x-ray ± hip USS at initial presentation. Safety-net advice for parents/carers is vital and children need review if symptoms do not settle.
- Given his age and the clinical scenario, the most likely diagnosis was transient synovitis (or early Perthes' disease). In the older child (> 11 years old), slipped upper femoral epiphysis (SUFE) would need to be considered and 'frog-leg' lateral hip x-ray undertaken.

Two weeks after the initial presentation, James continued to have a mild limp so his parents contacted the ED and he was reviewed in the orthopaedic department. On examination he still had some limitation of hip movement and pain on abduction and internal rotation. Plain hip x-ray was repeated and showed early signs of Perthes' disease.

COMMENT

- Most cases of transient synovitis respond quickly to analgesia and rest. Review is necessary when the limp persists to exclude evolving Perthes' disease (Table 2). If repeat radiographs are normal then bone scan or MRI may be indicated.
- The aim of treatment of Perthes' disease is to prevent deformity of the femoral head, which could lead to early osteoarthritis of the hip. Prognosis is variable but best with early detection, young age (< 6 years) and where the femoral head is minimally involved[23,24].

A CASE OF CHRONIC INTERMITTENT LIMP

Jane, a previously fit and well 4 year old girl, presented to her GP with a 7 week history of limp associated with intermittent right knee swelling observed by her parents. There was no history of preceding trauma or systemic upset. She was reluctant to weight bear in the mornings and more "grumpy" than usual but otherwise was well in herself. She was reluctant to sit cross-legged on the floor when playing, and kept her right leg outstretched. On examination, Jane was afebrile, looked well and general examination was normal. Her right knee was warm and

slightly swollen but not red or tender. She was reluctant to fully extend or flex her knee. Initial investigations revealed normal FBC, blood film, ESR, CRP and knee X-ray. A presumptive diagnosis of reactive arthritis was made. Jane was discharged after 48 hours of observation on the ward.

COMMENTS

- Jane's history was of several weeks duration and she was systemically well. There were no "red flags" in the initial presentation and the working differential diagnosis should include conditions that are associated with chronic or persistent limp (Table 1 and 2). By 6 weeks, an episode of reactive arthritis should have resolved.

- The absence of a definitive diagnosis and persistent symptoms always warrants review.

Two weeks later Jane was referred to the paediatric department by her GP. She was increasingly reluctant to walk. Both knees were swollen and displayed early flexion deformities. Examination of her joints also revealed swelling of the right ankle. Systemic examination was otherwise unremarkable. Blood tests (FBC, blood film and acute phase reactants) were normal and auto-antibodies were negative. The orthopaedic team arranged an MRI of both lower limbs under general anaesthetic; an effusion in both knees and the right ankle were confirmed.

COMMENTS

- The chronicity and periodicity of Jane's symptoms, gelling and stiffness after rest, and involvement of more than one joint suggest an inflammatory arthritis. In the UK, JIA is the most likely cause of chronic arthritis (i.e. > 6 weeks). JIA is a group of disorders characterised by arthritis of > 6 weeks duration, presenting before the age of 16 following exclusion of other conditions and with a spectrum of presentations and clinical courses[25]. Optimal outcome rests on early diagnosis and prompt referral to paediatric rheumatology specialist teams as emphasised in the Standards of Care for JIA (www.bspar.org.uk) [26].

Early diagnosis of JIA rests on suspicion and careful clinical assessment:

- In JIA pain may not be verbalised especially in the very young, but may be suggested by a change in the child's mood, sleep pattern, change in activities (play, sport and where appropriate school work) and the effect of analgesics or non-steroidal anti-inflammatory drugs. The child with JIA may avoid or adapt certain activities that are uncomfortable or may be noted to be "clumsy" or have regression in achieved motor milestones (such as walking).
- The pGALS (paediatric Gait, Arms, Legs and Spine) musculoskeletal examination (Tables 4 and 5) helps identify abnormal joints which can then be examined further using a more detailed approach to joint examination such as pREMS (Table 4). pGALS has been validated for the school aged child [6], but can be used in younger children in a "copy me" style and has been shown to be effective in acute paediatric practice[27] . pGALS may help detect abnormal joints that are not apparent from the history alone[7] especially when the symptoms are

vague and illocalised. Joint swelling can be difficult to detect clinically. Ankle swelling as part of pGALS is best observed from behind, with associated calf wasting suggesting chronicity.

- It is advisable to refer to paediatric rheumatology when JIA is suspected, and especially *prior* to contemplating invasive procedures (e.g. arthroscopy / synovial biopsy / MRI), which are invariably not necessary to confirm the diagnosis; delay in access to such tests may incur further delay to referral and starting treatment. If MRI is required, then Gadolinium should be given, as enhancement is helpful to detect synovitis. Ultrasound is increasingly used to assess for synovitis in children as it does not require sedation or general anaesthesia.
- Eye screening (using slit lamp examination) is essential when JIA is suspected. Visual involvement with uveitis is potentially blinding and is invariably asymptomatic in the early stages.
- There is no diagnostic test for JIA. Investigations (FBC, ESR and CRP) may be normal although more severe subtypes have raised acute phase reactants and anaemia. A positive antinuclear antibody (ANA) is not diagnostic and can be found in up to 33% of normal healthy children[(28)]. When present in children with JIA, ANA indicates a higher risk of chronic anterior uveitis. Rheumatoid factor is invariably negative but in polyarticular JIA, indicates a more guarded prognosis.
- Growing pains are a common label used to describe children with aches and pains of unclear cause[29]. Persistent limp and daytime symptoms are exclusion criteria for growing pains and in such children further assessment is needed [30].

- It is noteworthy that in a child with a persistent limp, it is important to also consider inflammatory muscle disease and careful assessment for skin rash and proximal muscle weakness is necessary (inability to jump in a school aged child or an abnormal Gower's test suggests proximal muscle weakness). Measurement of muscle enzymes is warranted.

Jane has a diagnosis of oligoarticular JIA (i.e. arthritis of ≤4 joints during the first 6 months of disease), the most common JIA subtype with an excellent prognosis albeit high risk of uveitis. Jane had flexion contractures, which can be avoided by early joint injection with steroids and physiotherapy. Regular eye screening is mandatory. More than 1/3 of children with oligoarticular JIA will develop – so called extended oligoarticular JIA with a guarded prognosis and invariably treated with methotrexate [24].

LIMPING CHILD GUIDELINES

- There is currently no agreed evidence or consensus based clinical guidelines for the limping child.
- Limping child guidelines should be locally agreed between A&E, paediatric and orthopaedic departments to help exclude serious life threatening pathology and facilitate early detection of potentially disabling conditions such as Perthes', SUFE and JIA.
- Limping child guidelines need to contain discharge criteria, indications for review and referral for children who fail to improve

- Parent information leaflets need to include advice on analgesia, when to return the child for review if symptoms do not settle or worsen.

- The management of persistent limp and referral to other sub-specialties such as paediatric rheumatology needs to avoid any undue delay.

- Common pitfalls to be avoided in the limping child are shown in Table 8.

TABLE 8: COMMON PITFALLS TO BE AVOIDED

Ascribing limp to trauma and overlooking features that suggest other causes Referred pain (e.g. from the abdomen (and testes in boys), back or chest and hip pathology manifesting as knee pain).
Think beyond the hip (!) and examine the child comprehensively.
Classical clinical features of sepsis may be masked in the immunosuppressed child.
Mycobacterial infection can be easily missed.
Synovial fluid may be sterile in partially treated septic arthritis.
Labelling children with daytime symptoms as having “growing pains”.
Medically unexplained limp or physical symptoms warrant specific management and referral (i.e. discharge without a diagnosis and follow up plan is not advised).
The blood film may be normal in children with malignancy.
Radiographs are often normal in children with early sepsis or arthritis.
Acute phase reactants may be normal in children with arthritis.
Rheumatoid factor is usually negative in children with arthritis.
Antinuclear antibody and rheumatoid factors may be false positives in children without inflammatory joint or muscle disease.

CLINICAL MESSAGES

The ‘limping child’ is a common presentation - careful clinical assessment, knowledge and judicious use of often simple investigations will often facilitate a correct diagnosis.
The hip is a common site of pathology but it is important to exclude pathology elsewhere.
Kocher’s clinical prediction rule is the most useful tool to date to help distinguish between septic arthritis and transient synovitis, however requires further validation in a large prospective study.
USS is more sensitive than plain x-ray for the detection of hip effusions
Limping is not a diagnosis - all children need clear follow-up plans and a parent information leaflet to indicate when and how parents can seek further medical advice.

If a limp persists (> 3 weeks), then the likelihood of JIA is high and referral to paediatric rheumatology is recommended and *before* contemplating invasive investigations which may be unnecessary.

COMPETING INTERESTS

None

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